

Claims

- [1] A method for forming a light-emitting layer by atomic or molecular layer deposition, comprising the steps of:
 - 1) placing a substrate in a reaction chamber and maintaining the inner temperature of the reaction chamber at a specific reaction temperature;
 - 2) feeding a metal-containing material into the reaction chamber and reacting the material with the substrate; and
 - 3) feeding an 8-hydroxyquinoline derivative into the reaction chamber and reacting the raw materials.
- [2] The method according to claim 1, further comprising the step of removing unreacted raw materials and by-products by first purging after step 2) and prior to step 3).
- [3] The method according to claim 1, further comprising the step of removing unreacted raw materials and by-products by second purging after step 3).
- [4] The method according to claim 1, wherein steps 2) and 3) are repeated twice or more.
- [5] The method according to claim 1, wherein the metal-containing material and the 8-hydroxyquinoline derivative are fed into the reaction chamber for 0.1~500 seconds.
- [6] The method according to claim 2, wherein the first purging is carried out by absorbing and removing unreacted raw materials and by-products using a vacuum pump disposed in the reaction chamber.
- [7] The method according to claim 2, wherein the first purging is carried out by supplying a purge gas selected from the group consisting of helium (He), hydrogen (H₂), nitrogen (N₂) and argon (Ar) to the reaction chamber, and absorbing and removing gases present in the reaction chamber using a vacuum pump disposed in the reaction chamber.
- [8] The method according to claim 7, wherein the purge gas is supplied at a flow rate of 1~5,000 sccm for 0.1~500 seconds.
- [9] The method according to claim 3, wherein the second purging is carried out by absorbing and removing unreacted raw materials and by-products using a vacuum pump disposed in the reaction chamber.
- [10] The method according to claim 3, wherein the second purging is carried out by supplying a purge gas selected from the group consisting of helium (He), hydrogen (H₂), nitrogen (N₂) and argon (Ar) to the reaction chamber, and absorbing and removing gases present in the reaction chamber using a vacuum pump disposed in the reaction chamber.

[11] The method according to claim 10, wherein the purge gas is supplied at a flow rate of 1~5,000 sccm for 0.1~500 seconds.

[12] A method for forming a light-emitting layer by chemical vapor deposition, comprising the steps of:
1) placing a substrate in a reaction chamber and maintaining the inner temperature of the reaction chamber at a specific reaction temperature; and
2) simultaneously feeding a metal-containing material and an 8-hydroxyquinoline derivative into the reaction chamber with or without carrier gas and reacting the raw materials.

[13] The method according to claim 12, further comprising the step of removing unreacted raw materials and by-products by purging after step 2).

[14] The method according to claim 12, wherein step 2) is repeated twice or more.

[15] The method according to claim 12, wherein the metal-containing material and the 8-hydroxyquinoline derivative are fed into the reaction chamber for 1 seconds to one hour.

[16] The method according to claim 13, wherein the purging is carried out by absorbing and removing unreacted raw materials and by-products using a vacuum pump disposed in the reaction chamber.

[17] The method according to claim 12 and 13, wherein the carrier or the purge is carried out by supplying a gas selected from the group consisting of helium (He), hydrogen (H₂), nitrogen (N₂) and argon (Ar) to the reaction chamber, and absorbing and removing gases present in the reaction chamber using a vacuum pump disposed in the reaction chamber.

[18] The method according to claim 17, wherein the carrier gas or the purge gas is supplied at a flow rate of 1~5,000 sccm for 1~60 minutes.

[19] The method according to claim 1 or 12, wherein the reaction temperature is between 15°C and 500°C.

[20] The method according to claim 1 or 12, wherein the metal-containing material is selected from aluminum-, gallium- and zinc-containing materials.

[21] The method according to claim 20, wherein the aluminum-containing material is selected from the group consisting of:
trimethylaluminum (TMAI);
trimethylaluminum-dimethylethylamine (TMAI-DMEA);
trimethylaluminum-trimethylamine (TMAI-TMA);
trimethylaluminum-triethylamine (TMAI-TEA);
trimethylaluminum-methylpyrrolidine (TMAI-MP);
trimethylaluminum-ethylpyrrolidine (TMAI-EP);
trimethylaluminum-ethylpiperidine (TMAI-EPP);

trimethylaluminum-ethylmorpholine (TMA1-EMP);
triethylaluminum (TEAl);
triethylaluminum-dimethylethylamine (TEAl-DMEA);
triethylaluminum-trimethylamine (TEAl-TMA);
triethylaluminum-triethylamine (TEAl-TEA);
triethylaluminum-methylpyrrolidine (TEAl-MP);
triethylaluminum-ethylpyrrolidine (TEAl-EP);
triethylaluminum-ethylpiperidine (TEAl-EPP); and
triethylaluminum-ethylmorpholine (TEAl-EMP).

- [22] The method according to claim 20, wherein the aluminum-containing material is selected from the compounds listed in Table 1.
- [23] The method according to claim 20, wherein the gallium-containing material is selected from the compounds listed in Table 2.
- [24] The method according to claim 20, wherein the zinc-containing material is selected from the compounds listed in Table 3.
- [25] The method according to claim 1 or 12, wherein the 8-hydroxyquinoline derivative is selected from the compounds listed in Figure 4.
- [26] The method according to claim 1 or 12, wherein the metal-containing material and the 8-hydroxyquinoline derivative are vaporized before being fed into the reaction chamber.